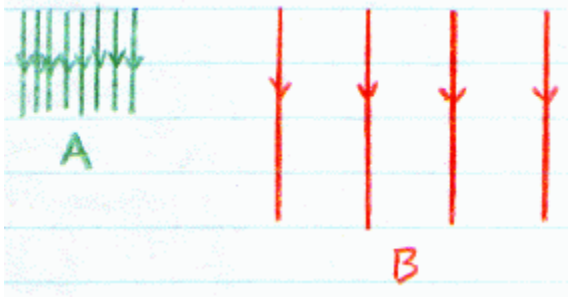
DAY 2 -- Homework

1. In the figures below, which field is stronger, A or B?

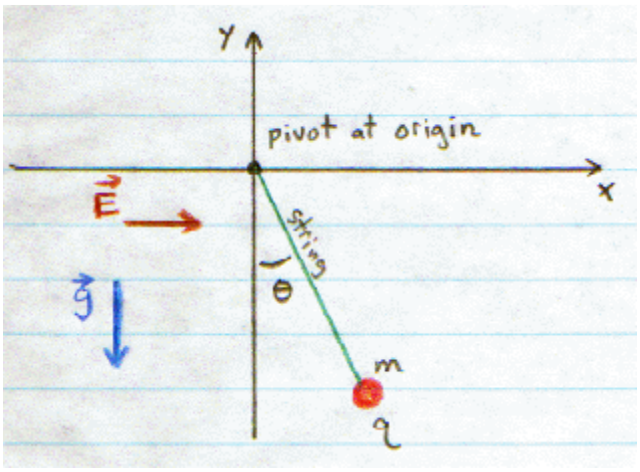


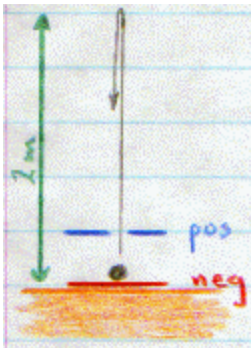
2. proton $m = 1.0u$ $q = 1e$
neutron $m = 1.0u$ $q = 0$
electron $m = .00055u$ $q = -1e$

$1u = 1.66 \times 10^{-27}$ kg
$1e = 1.60 \times 10^{-19}$ C

A neutral nitrogen atom (7 protons, 7 neutrons, 7 electrons) passes between two charged plates where there is a uniform electric field of $E = 50$ kV/cm. Two electrons are stripped from the atom by the E field. If the plates are separated by 10 cm and the neutral atom was 5 cm from each plate, how far will the Nitrogen ion have moved toward the negative plate by the time the electrons hit the positive plate?

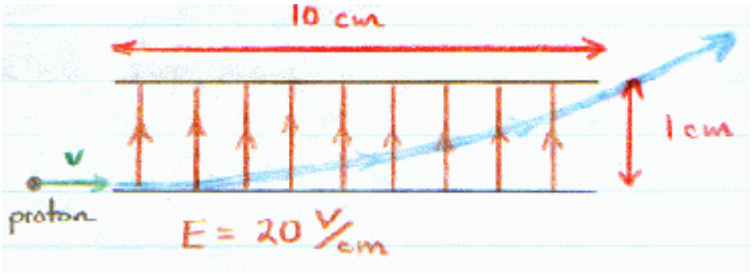
3. A ball of mass m and charge q is tethered by a string to a fixed point and subjected to uniform, perpendicular $\vec{g}$ and $\vec{E}$ fields. Derive an equation for θ in terms of m, q, g, and E.



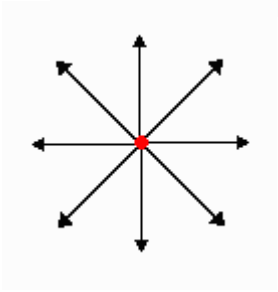
4. 

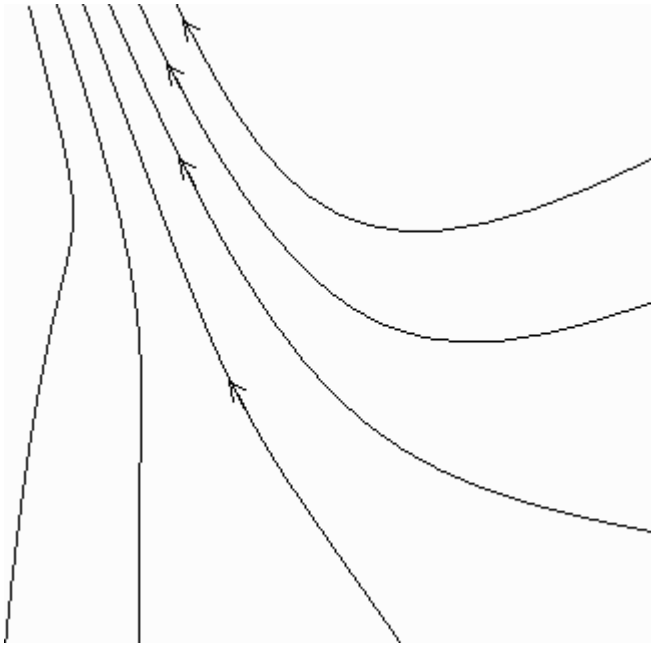
In a lab a 1 kg ball is given a charge. The ball is then placed between two horizontal plates. 200 Volts are applied to the plates, which causes the ball to fly up through a hole in the upper, positively charged plate. If the ball rises to a height of 2 m, what was the charge on the ball?

5. In the figure, what is the smallest v the proton can have and still clear the top plate?

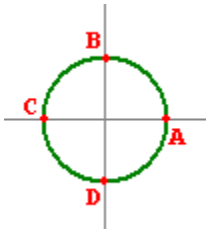


6. For each of the three fields shown, sketch the equipotential surfaces.





7. An electric field has magnitude 10,000 N/C and direction of 45° measured from the positive x axis. A ring of diameter 20 cm is centered on the origin and sits in the field (see figure below) Find ΔU_{AB}, ΔU_{AC}, ΔU_{BD}, ΔU_{AD}.



8. In the above problem, protons can travel freely through the ring.

   How fast must a proton be launched from A (clockwise) in order to reach B?

9. In the ring problem, how fast must a proton be launched (clockwise) from D in order to reach C? What if it is launched at this speed from D in the counter-clockwise direction?

10. An electric field of strength 100 N/C is directed downward (-y or "**-j**" direction). A mass of 0.1 kg and charge of -0.1 C can slide along a wire that starts at the origin and has a shape of a parabola ($y = x^2$). If the mass is released at the origin, find its speed when it is at x = 1 meters and x = 2 meters. Obtain an equation for the speed of the mass at any x value.